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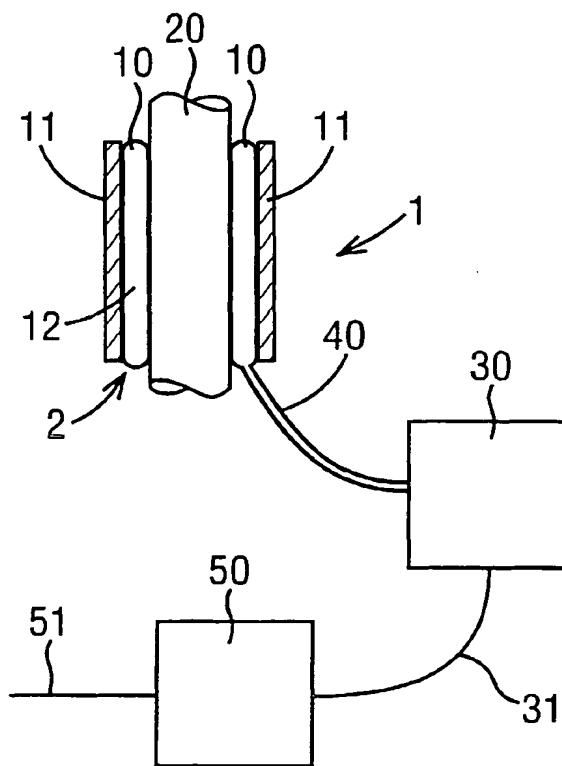
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[Continued on next page]

(54) Title: A BLOOD CIRCULATION ASSISTANCE DEVICE



(57) Abstract: A blood circulation assistance device (1), for location around a blood conduit (20). The device comprises: an inflatable bladder (10) moveable between a contracted form and an expanded form, for compressing the blood conduit (20) to provide counterpulsation. Pump means (30) in fluid communication with the bladder (10) move the bladder (10) from the contracted form to the expanded form. The pump means (30) comprises a centrifugal impeller (62) rotatable about an axis (61) to effect pumping. The impeller (62) is moveable axially between first and second positions to effect a reversal of the direction of pumping. Control means (50), in communication with the pump means, is capable of monitoring the cardiac cycle of an individual and triggering the pump means (30) to move the bladder (10) to the expanded form at diastole. An outer cuff, surrounds at least a portion of the bladder (10), providing an outer limiting extent to the movement of the bladder (10).



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INTERNATIONAL SEARCH REPORT

In national Application No
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A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 A61M1/10 F04B43/08 F04B43/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 A61M F04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	<p>WO 93 05827 A (MEDTRONIC INC) 1 April 1993 (1993-04-01)</p> <p>page 5, line 1 -page 9, line 10 page 13, line 22-34 page 13, line 1-5 page 15, line 7-32 page 16, line 6-16 page 17, line 22-28 page 19, line 5-12 figures 1-4</p> <p style="text-align: center;">--- -/-</p>	<p>1-15, 18, 19, 27-31, 33, 35</p>



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "&" document member of the same patent family

Date of the actual completion of the international search

27 March 2002

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 01/04250

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5 346 458 A (AFFELD KLAUS) 13 September 1994 (1994-09-13) column 2, line 27 -column 3, line 68 figures 1-4 ---	1-15,18, 19, 27-31, 33,35
A	US 4 979 936 A (ACKER MICHAEL A ET AL) 25 December 1990 (1990-12-25) column 6 -column 8 figures 1-3 ---	1,2
A	WO 99 04833 A (COMMISSARIAT ENERGIE ATOMIQUE ;BOUVIER ALAIN (FR); SQUARA PIERRE ()) 4 February 1999 (1999-02-04) page 9, line 8 -page 11, line 8 figure 4 ---	20-24
A	WO 95 28127 A (ALLEGHENY SINGER RES INST ;CLARK RICHARD E (US); PACELLA JOHN J (U) 26 October 1995 (1995-10-26) page 10, line 10-13 page 20, line 23-30 figure 5 ---	20,21,34
A	US 5 429 584 A (CHIU RAY C) 4 July 1995 (1995-07-04) column 5, line 1-15 column 5, line 35-44 figures 5A,5B ---	22-24,28
A	US 4 014 318 A (NITZKOWSKI NORMAN H ET AL) 29 March 1977 (1977-03-29) column 1, line 47-53 column 2, line 39-54 column 3, line 2 -column 4, line 37 column 5, line 12-15 figures 1,6 ---	53-56
A	FR 1 562 754 A (ZACOUTO, M.F.) 11 April 1969 (1969-04-11) page 1 figure 1 -----	53,54

INTERNATIONAL SEARCH REPORT

national application No.
PCT/GB 01/04250

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☒ Claims Nos.: 36-52
because they relate to subject matter not required to be searched by this Authority, namely:
Rule 39.1(iv) PCT - Method for treatment of the human or animal body by therapy
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 2-35

A blood circulation assistance device comprising at least one inflatable bladder moveable between an expanded and a contracted state, an outer cuff surrounding at least a portion of the at least one inflatable bladder and providing an outer limiting extent to the movement of the at least one inflatable bladder, and further comprising pump means, in fluid communication with the at least one inflatable bladder, the pump means comprising a centrifugal impeller rotatable about an axis to effect pumping, the impeller being moveable axially between first and second positions.

1.1. Claims: 1,3-35

2. Claims: 53-56

A blood circulation assistance device comprising solid state compression means moveable between a contracted form and an expanded form, an outer cuff, surrounding at least a portion of the solid state compression means and providing an outer limiting extent to the movement of said solid state compression means, and further comprising control means in communication with said solid state compression means and being capable of monitoring the cardiac cycle of an individual and triggering the solid state compression means to move to the expanded form at diastole, the solid state compression means being locatable between the blood conduit and the outer cuff.

Please note that all inventions mentioned under item 1, although not necessarily linked by a common inventive concept, could be searched without effort justifying an additional fee.

INTERNATIONAL SEARCH REPORT

International Application No

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